Solubility of solids in solutions with a common ion

1) Determine whether a precipitate of iron(III) hydroxide, $Fe(OH)_3$, will form when $Fe(NO_3)_3$ is dissolved in water. $[Fe(NO_3)_3] = 1.05 \times 10^{-4}$ mol L^{-1}. Assume the pH of the water is 7. $Ks(Fe(OH)_3) = 2.00 \times 10^{-39}$

2) Discuss how the solubility of Ag_2CrO_4 will change if it is dissolved in 0.1 mol L^{-1} K_2CrO_4

No calculations are necessary.

3) Sea water contains many dissolved salts. The chloride ion concentration in a sample of sea water is 0.440 mol L^{-1}. Determine whether a precipitate of lead(II)chloride will form when a 1.00 g sample of lead(II) nitrate is added to 500 mL of the sea water. Your answer must be clearly justified.
$M(Pb(NO_3)_2) = 331$ g mol^{-1}

4) Evaporating the sea-water to dryness would produce a mixture of salts including NaCl. However, precipitation of NaCl occurs if concentrated hydrochloric acid is added to a saturated NaCl solution. Explain why this precipitation occurs.

5) a) The chloride ion concentration in sea water can be determined by titrating a sample with aqueous silver nitrate ($AgNO_3$) using potassium chromate (K_2CrO_4) as the indicator. As the silver nitrate is added, a precipitate of silver chloride, (AgCl) forms. When most of the AgCl has precipitated, the $Ag^+(aq)$ concentration becomes high enough for a red precipitate of Ag_2CrO_4 to form. Show that the solubility of Ag_2CrO_4 in pure water at 25°C is higher than that of AgCl.
$Ks(AgCl) = 1.56 \times 10^{-10}$ $Ks(Ag_2CrO_4) = 1.30 \times 10^{-12}$

b) If the concentration of chromate ions is 6.30×10^{-3} mol L^{-1} at the point when the Ag_2CrO_4 starts to precipitate, calculate the concentration of Ag^+ ions in the solution.

6) Fluoridation of a water supply produces a fluoride concentration of approximately 5 x 10^{-5} mol L^{-1}. Will calcium fluoride (CaF_2) precipitate in a hard water supply where the concentration of calcium ions is 2 x 10^{-4} mol L^{-1}? K_s (CaF_2)= 3.2 x 10^{-11}